CHAPTER 12

HAZARDOUS MATERIALS SPILLS/WASTE OPERATIONS

1. **GENERAL.**

a. When workers respond to hazardous substance/waste emergencies or when they work with hazardous wastes during storage, treatment, and disposal operations, there are a multitude of chemical, physical, biological and safety hazards. The industrial hygienist's role in these operations is to provide technical assistance, primarily to the installation or command environmental manager. This includes conducting workplace hazard evaluations and health risk assessments and determining the need for engineering, personal protective equipment, and work practice controls.

b. The purpose of this chapter is to summarize basic requirements and protocols for protecting the safety and health of workers involved in hazardous waste operations and/or emergency response for hazardous substances released into the environment. The following documents should be obtained for full hazardous waste and emergency response operations program implementation.

(1) 29 CFR 1910.120 - *Hazardous Waste Operations and Emergency Response*. Regulates the safety and health of employees involved in cleanup operations at uncontrolled hazardous waste sites being remediated under government mandate, in certain hazardous waste treatment, storage, and disposal operations conducted under the Resource Conservation and Recovery Act (RCRA) of 1976, and in any emergency response to incidents involving hazardous substances.

(2) 40 CFR 261 - *Identification and Listing of Hazardous Waste*. Identifies solid wastes that are subject to regulation under Title 40 and to the modification requirements of section 3010 of RCRA. It also provides a list of hazardous wastes.

(3) 40 CFR 262 - *Standards Applicable to Generators of Hazardous Waste*. Establishes regulations for generators of hazardous waste.

(4) 40 CFR 263 - *Standards Applicable to Transporters of Hazardous Waste*. Establishes regulations for transporting hazardous waste within the United States if the transportation requires a manifest under 40 CFR 262.

(5) 40 CFR 264 - *Standards for Owners and Operators of Hazardous Waste Treatment, Storage, And Disposal Facilities*. Defines the minimum national standards for the acceptable management of hazardous waste.

(6) 40 CFR 265 - *Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities.* Defines the minimum national standards for the acceptable management of hazardous waste during the period of interim status.

(7) 49 CFR 171 - *General Information, Regulations, and Definitions*. Presents the Department of Transportation (DOT) requirements on the transportation of hazardous waste. Included are definitions and abbreviations used by DOT in reference to shippers (generators) and carriers (transporters) of hazardous waste.

(8) OPNAVINST 5090.1 Series - *Environmental and Natural Resources Program Manual.* Applicable to all Navy commands, afloat and ashore. It includes guidance for hazardous waste management, new requirements for solid waste management plans, and information on oil and hazardous substances spills and releases.

c. Appendix 12-A lists additional references that are helpful for handling hazardous spill and waste operations.

2. **DEFINITIONS**.

a. Corrosive. A liquid or solid that causes visible destruction or irreversible alterations in human skin tissue at the site of contact.

b. Hazardous material (HAZMAT). Any material defined by 29 CFR 1910.1200 to be a hazardous material or any material, other than waste, that exhibits the characteristics of reactivity, corrosivity, ignitability, or is listed in the EPA Hazardous Waste Listing and can be reused, recycled, reclaimed, or sold as a usable product.

c. Hazardous waste. Any used hazardous material that exhibits the characteristic of: 1) ignitability, 2) corrosivity, 3) reactivity, or 4) is listed in 40 CFR Part 261, Subpart D.

d. Ignitability. Ignition is the process of initiating self-sustained combustion. If ignition is caused by the introduction of some external flame, spark, or glowing object, it is piloted ignition. If it occurs without the assistance of an external pilot source, it is autoignition.

e. Reactivity. Reactive materials are substances that undergo violent or abnormal chemical reactions in the presence of air, water, heat, or shock.

f. Time weighted average (TWA). The employee's average airborne exposure to a chemical or physical stressor in any 8-hour work shift of a 40-hour work week which shall not be exceeded.

g. Toxicity characteristic leachate procedure (TCLP). A test that measures the tendency of the hazardous constituents of a waste to migrate (or leak) out of a landfill and contaminate the surface of ground water.

3. **SAFETY AND HEALTH PROGRAM.** Safety and health programs must cover the following topics:

a. Written health and safety program. This program must be implemented for those workers involved in hazardous waste operations. The program must be designed to identify, evaluate, and control health and safety hazards, and to provide for emergency response for hazardous waste operations. 29 CFR 1910.120 discusses the organizational structure, comprehensive work plan, and the site-specific health and safety plan (HASP) that must be incorporated in the written health and safety program. Comprehensive and site-specific components are shown in Table 12-1. A brief summary of HASP components with a sample HASP table of contents is provided in Appendix 12-B.

b. Site excavations. Site excavations, created during initial site preparation or during hazardous waste operations, must be shored or sloped as appropriate to prevent collapse in accordance with 29 CFR 1926, Subpart P (Excavations, Trenching, and Shoring).

c. Contractors and sub-contractors. Any activity which retains contractor or sub-contractor services for work in hazardous waste operations must inform those contractors, sub-contractors, or their representatives of the site emergency response procedures and any potential fire, explosion, health, safety, or other hazards of the hazardous waste operation that have been identified in the activity's information program.

d. Program availability. The written health and safety program must be made available to:

(1) Contractors, sub-contractors, or any representatives of a contractor or sub-contractor who will be involved with the hazardous waste operation;

(2) Worker designated representatives;

(3) OSHA personnel; and

(4) Personnel of other agencies with regulatory authority over the site.

4. **SITE CHARACTERIZATION AND ANALYSIS**. Hazardous waste sites must be evaluated to identify specific site hazards and to determine the appropriate safety and health procedures needed to protect workers from the identified hazards.

a. Site evaluations. Site characterization is a continuous process with three phases. Information should be obtained at each phase to evaluate and define the hazards that the site may impose.

(1) Preliminary off-site characterization. Prior to site entry, off-site characterization should be conducted to gather information about the site and to conduct reconnaissance from the site perimeter. This phase will aid in the selection of worker protection for the next phase of the characterization.

(a) Conduct interviews. Interviews with site personnel and other individuals who may have information pertaining to the identity of unknown hazardous substances.

(b) Review records. A review of any records which may help identify the unknown substances, such as storage inventories, shipping papers, procurement papers, generator records, records from regulatory agencies, etc.

(c) Perimeter reconnaissance. Prior to entering a site, a preliminary investigation should be conducted around the site to obtain information on the substances present and the condition of storage. Note such things as labels; types of containers; amount of deterioration or damage of containers; conditions such as odors, vapors, clouds, oil slicks, or other unusual occurrences.

(d) Perimeter monitoring. Conduct monitoring of ambient air at the perimeter of the site to determine the presence of an explosive atmosphere, oxygen deficiency, radiation or inorganic/organic gases and vapors. The method of measurement to determine their presence and guidance regarding actions to be taken as a result of measuring certain levels are listed in Table 12-2. A description of operability and function of selected direct reading instruments is given in Table 12-3. Fixed location monitoring at the "fenceline" or perimeter (defined as the boundary where personal protective equipment is no longer

required) measures contaminant migration away from the site and enables the Site Safety Officer to evaluate the integrity of the site's clean areas. Since the fixed location samples may reflect exposures either upwind or downwind from the site, wind speed and direction data are needed to interpret the sample results.

(2) On-site surveys. The purpose of the on-site survey is to verify and supplement information from the off-site characterization. Table 12-4 is a checklist of parameters to be noted during the survey. If the results of the off-site survey show Immediately Dangerous to Life or Health (IDLH) conditions or other dangerous conditions, exercise extreme caution when continuing the site survey.

(a) Conduct air monitoring first to identify any IDLH and other dangerous conditions, such as flammable or explosive atmospheres, oxygen-deficient environments, and toxic levels of airborne contaminants. Direct-reading monitoring instruments will normally include combustible gas indicators, oxygen meters, colorimetric indicator tubes, and organic vapor monitors. Other monitoring instruments may be necessary based on the initial site characterization. When time permits, air samples should be collected for laboratory analysis. Extreme caution should be exercised in continuing a site survey when atmospheric hazards are indicated. Monitoring personnel should be aware that conditions can suddenly change from nonhazardous to hazardous. Further, hazardous concentrations of chemicals may persist in confined and low-lying spaces for long periods of time. Look for any natural or artificial barriers such as hills, tall buildings, or tanks, behind which air might be still, allowing concentrations to build up. Examine confined spaces such as cargo holds, mine shafts, silos, storage tanks, box cars, buildings, bulk tanks, and sumps where chemicals capable of causing acute health effects may accumulate. Low-lying areas, such as hollows and trenches, are also suspect. Monitor these spaces for IDLH and other dangerous conditions. Also consider whether the suspected contaminants are lighter or heavier than air. Then, based on the type of contaminants present, consider sampling on hilltops, under any cover or canopy where workers might work or congregate, and in trenches and low-lying areas. In open spaces, toxic materials tend to be emitted into the atmosphere, transported away from the source, and dispersed. Acutely hazardous conditions are not likely to persist in open spaces for extended periods of time unless there is a very large (and hence, readily identifiable) source, such as an overturned tank car. Open spaces are therefore generally given a lower monitoring priority.

(b) If time allows, general on-site monitoring should be conducted to identify the major classes of airborne

contaminants and their concentrations. Level B protection (see Appendix 12-C) should be worn during this initial sampling, with levels of protection for subsequent sampling based upon the results obtained and the potential for an unexpected release of chemicals.

The following sampling pattern can be used as a guideline: (1) visually identify sources of possible generation; (2) collect air samples downwind from the designated source along the axis of the wind direction; (3) work upwind until reaching or getting as close as possible to the source.

(3) Periodic monitoring. Once a site has been determined safe for commencement of other activities, perform ongoing monitoring to provide a continuous status of site conditions. Because site activities/conditions may change following the initial characterization, monitoring should be repeated periodically, especially when:

(a) Work begins on a different portion of the site;

(b) Different contaminants are being handled;

(c) A markedly different type of operation is initiated;

(d) Workers are handling leaking drums or working in areas with obvious liquid contamination; or

(e) Change of weather condition warrants resampling.

b. Identification of hazards.

(1) Exposure to toxic chemicals. Chemicals can exist in the gaseous, liquid, or solid form. They can enter the body by inhalation, skin absorption, ingestion, or through a wound. Chemicals can produce either acute or chronic effects.

(a) Acute effects. These result from exposures that occur for short periods of time, generally hours to 1-2 days. They are typical in transportation accidents, fires, or releases at chemical manufacturing or storage facilities. Acute air or skin exposures can occur when workers must be close to the chemicals in order to control the release. Examples include: patching a tank car or off-loading a corrosive material; containing and treating exposed material; start-up of abandoned waste sites where workers are sampling or handling containers. In all of these scenarios, workers face the risk of acute exposures from chemical splashes and from generated vapors, gases, or particulates.

(b) Chronic effects. These result from exposures that occur over longer periods of time, generally months to years. They are usually associated with longer term remedial operations and can arise from contaminated soil and debris generated from emergency operations or abandoned waste sites.

(2) Fires and explosions.

(a) Result from chemical reactions, ignition of explosive or flammable chemicals, ignition of materials due to oxygen enrichment, or agitation of shock or friction-sensitive compounds.

(b) Can be caused by moving drums, accidentally mixing incompatible chemicals, or introducing an ignition source (such as a spark from equipment) into an explosive or flammable environment.

(c) Can result in intense heat and release of toxic chemicals into the environment, potentially affecting personnel on site and the general public living or working nearby.

(3) Oxygen deficiency.

(a) Oxygen deficiency is defined as less than or equal to 19.5% oxygen. Being in oxygen deficient atmospheres can result in physiological effects, including impaired attention and increased breathing and heart rate.

(b) May result from the displacement of oxygen by another gas or the consumption of oxygen by a chemical reaction.

(c) Confined spaces or low-lying areas are susceptible to oxygen deficiency and must be monitored prior to entry.

(d) Precautions include periodic monitoring of oxygen levels and the implementation of a confined space entry permit system. Personnel must wear atmosphere-supplying respirators when oxygen concentrations fall below 19.5%.

(4) Ionizing radiation.

(a) Alpha particles.

(i) Particulate radiation.

(ii) Limited penetration ability.

(iii) Usually stopped by clothing.

(iv) Pose little threat outside of the body.

(v) Hazardous inside of the body if materials that emit this radiation are inhaled or ingested.

(vi) Use of protective clothing, personal hygiene, and decontamination affords good protection.

(b) Beta particles.

(i) Particulate radiation.

(ii) Can penetrate the body to a depth of 1/2 inch.

(iii) Can cause harmful burns to the skin.

(iv) Can damage the blood system.

(v) Hazardous inside of the body if materials that emit this radiation are inhaled or ingested.

(vi) Use of protective clothing, personal hygiene, and decontamination affords good protection.

(c) Gamma radiation.

(ii) Electromagnetic radiation.

(ii) Most serious form of ionizing radiation.

(iii) Easily passes through clothing and human tissue.

(iv) Can cause serious permanent damage to the body.

(v) Cannot be stopped by chemical protective clothing.

(vi) Can be stopped by adequate thickness of concrete, steel, and lead.

(5) Heat stress. Protective clothing reduces the amount of heat and moisture that can escape from the body. Depending on climatic conditions and the type of work being performed, heat stress can occur rapidly and may result in impairment to the worker.

(a) Heat rash (prickly heat). This occurs when sweat glands become clogged and inflamed during heavy perspiration. A

tiny red rash appears in the affected areas. If extensive, the rash can become a deterrent to efficient performance. Treatment consists of resting in cool dry places to allow the skin to dry.

(b) Heat cramps. Symptoms include painful spasms of heavily used skeletal muscles. Workers sweat profusely and drink large volumes of water without replacement of electrolyte losses. Excess water seeps into active muscles and causes pain. Prevention is accomplished by normal amounts of salt in the diet, and the intake of electrolyte replacement solutions, such as Gatorade®.

(c) Heat exhaustion. Heat exhaustion results from sudden exposure to high temperatures. This can lead to dehydration, and finally leads to circulatory strain. Symptoms include extreme weakness or fatigue; nausea; headache; pale or flushed complexion; body temperature normal or slightly higher; moist skin; and vomiting and/or loss of consciousness in extreme cases. Treatment consists of moving the person to a cooler environment, and the intake of electrolyte replacement solutions.

(d) Heat stroke. Heat stroke is considered a medical emergency. It results from the failure of body's thermo-regulatory system due to stress. Sweating stops, and the body's ability to remove excess heat is eliminated. Symptoms include hot dry skin, extremely high body temperature, mental confusion, and loss of consciousness. Brain damage or death may occur if treatment to lower body temperature is not begun immediately. The worker should be moved to a cool area. Clothing should be soaked with cold water. Fanning the worker aids in reducing body temperature. Call for emergency assistance.

(e) Prevention of heat stress problems. Heat stress can be prevented by careful training of personnel. There should be frequent monitoring of personnel who wear protective clothing in hot environments. Schedule work and rest periods. Finally, there should be frequent replacement of fluids.

(6) Cold stress. A cold environment can reduce the temperature of the body and cause shivering, reduced mental alertness, and sometimes even loss of consciousness. Frostbite and hypothermia are the two major hazards of working in cold temperatures.

(a) Insulating barrier. The effects of cold depend on how well skin is insulated from the environment. The insulating barrier determines the rate of heat loss from the body by radiation, convection, conduction, and evaporation.

(b) Factors contributing to cold injury. Cold injury can be attributed to exposure to humidity and high winds, contact with wetness or metal, inadequate clothing, age, and poor general health.

(c) Frostbite. This injury occurs when there is freezing of the fluids around the cells of the body from extremely low temperatures. Frostbite results in damage to and loss of tissue. Damage can affect the outer layers of the skin and the deeper layers of body tissue. Results of frostbite are scarring, tissue death, and perhaps amputation. Symptoms of frostbite are a skin change to white or grayish yellow, progressing to reddish violet, and finally turning black as the tissue dies. Other symptoms include pain, blisters, and coldness and numbness in the affected area.

(d) Hypothermia. This is an injury that is caused by extreme exposure to cold. It may be caused by exposure to cold either in the air or from immersion in water. The body loses heat faster than it can generate heat resulting in a drop in body temperature. Symptoms of hypothermia are pain in the extremities (which may be the first warning of dangerous exposure to cold); uncontrollable shivering; sensation of cold; slowing of the heartbeat; and weak pulse and blood pressure changes. Other symptoms include slurred speech, memory lapses and drowsiness, and cool skin. If severe enough, the drop in temperature can result in stupor, coma, and even death. Protective clothing is essential for the conservation of body heat. Non-restricted clothing and multiple layers protect the worker because they trap air, providing added insulation. Clothing must be impermeable to perspiration (which promotes heat loss). Treatment of frozen body parts includes rewarming the area until thawed by immersion in a water bath of 104-106 F, or by rewarming the victim with the body of a fellow worker when in the field. Remove wet clothing and dry body parts. Maintain deep body temperature with blankets and warm liquids. Have the worker medically evaluated as soon as possible.

(7) Noise. Noise can be encountered at hazardous waste sites/spills from trucks, construction equipment, compressors, etc. Excessive noise can result in physical damage to the ear, pain, and temporary or permanent hearing loss.

According to OPNAVINST 5100.23 Series, Chapter 18, if exposures equal or exceed the TWA of 84 dBA, feasible administrative or engineering controls must be used. Employees must be enrolled in the hearing conservation program, which includes monitoring the employee's noise exposure, providing audiometric testing, and requirements for hearing protection, training, and recordkeeping.

c. Required information. Obtain the following information prior to site entry:

(1) Location and approximate size of the site;

(2) Description of the response activity and/or the job task to be performed;

(3) Duration of the planned activity of the worker;

(4) Site topography and accessibility by air and roads;

(5) Safety and health hazards expected at the site;

(6) Pathways for hazardous substance dispersion;

(7) Present status and capabilities of emergency response teams that can provide assistance to hazardous waste clean-up site workers at the time of an emergency; and

(8) Hazardous substances and health hazards involved or expected at the site and their chemical/physical properties.

d. Monitoring. The following must be conducted during initial site entry:

(1) Monitor for hazardous levels of ionizing radiation with direct reading instruments;

(2) Monitor the air with appropriate direct reading test equipment for IDLH and other conditions that may cause death or serious harm (combustible or explosive atmospheres, oxygen deficiency, and toxic substances);

(3) Visually observe for signs of actual or potential IDLH or other dangerous conditions; and

(4) Conduct an ongoing air monitoring program. This is to be done after site characterization has determined the site is safe for the start up of operations.

e. Risk identification. Inform employees of the identified risks (exposures exceeding permissible exposure limits, IDLH concentrations, potential skin absorption and eye irritation sources, explosion sensitivity and flammability ranges, and oxygen deficiency).

f. Hazardous Substance Information Form. Information on the chemical, physical, and toxicologic properties of each compound known or expected to occur on site should be recorded on a

Hazardous Substance Information Form (see Appendix 12-D). Response personnel will then have the necessary health and safety information in one place, and new personnel can be quickly briefed. As many reference sources as possible should be used to fill out the sheets because the information may vary from one source to another. Material Safety Data Sheets (MSDS) provided by chemical manufacturers are one source for this information.

5. **PERSONAL PROTECTIVE EQUIPMENT (PPE)**. Whenever engineering controls and work practices are not feasible, PPE must be used to protect personnel.

a. PPE selection. PPE must be selected and used which will protect employees from hazards identified during the site characterization and analysis. Appendix 12-C provides guidance on selecting PPE ensembles.

(1) Using information obtained from the site characterization and analysis, select an ensemble of PPE to use during initial entry which will provide protection to a level of exposure below permissible exposure limits for known or suspected hazardous substances and health hazards.

(2) If respiratory protection is warranted by the potential hazards identified during the preliminary site evaluation, and if positive-pressure self-contained breathing apparatus (SCBA) is not used as part of the entry ensemble, an escape SCBA of at least five minutes duration must be used by employees during initial site entry.

(3) If the site characterization does not produce sufficient information to identify hazards or suspected hazards, then Level B PPE (See Appendix 12-C) must be provided as minimum protection. Direct reading instruments must be used as appropriate for identifying IDLH conditions.

(4) Positive pressure SCBA or positive pressure airline respirators equipped with an escape air supply must be used for IDLH conditions.

(5) Totally encapsulating chemical protective suits must be used in conditions where skin absorption of a hazardous substance may result in a substantial possibility of immediate illness or injury, or impair the ability to escape. Appendix A of 29 CFR 1910.120 lists a test method which may be used to evaluate this requirement.

(6) Upgrade or downgrade the level of protection when additional information on site conditions so indicates (e.g., air

sample results, change in site conditions, new hazard introduced, etc.).

(7) PPE must meet the requirements of 29 CFR Part 1910, Subpart I - Personal Protective Equipment.

b. Personal protective equipment program. This must be a part of the safety and health program and the site-specific safety and health plan. The plan must address:

(1) PPE selection based upon site hazards;

(2) Use and limitations of the equipment;

(3) Duration of work;

(4) PPE maintenance and storage;

(5) PPE decontamination and disposal;

(6) PPE training and proper fitting;

(7) PPE donning and doffing procedures;

(8) PPE inspection procedures prior to, during, and after use;

(9) Evaluation of the effectiveness of the PPE program; and

(10) Limitations during temperature extremes, heat stress, and other appropriate medical considerations.

6. **SITE CONTROL.** Implement appropriate site control procedures to control exposures before clean-up begins. 29 CFR 1910.120 discusses the minimal elements of the Site Control Program which is part of the activity's safety and health program. An explanation of hazardous material control zones is provided in Appendix 12-E.

7. **TRAINING.** All employees working on site exposed to hazardous substances, health hazards, or safety hazards and their supervisors and management responsible for the site must receive training before engaging in hazardous waste operations. 29 CFR 1910.120 lists specific training requirements for different personnel functional groups, training certification, and qualification of trainers. A brief description of training levels and recommended description of training by job category is given in Appendix 12-F.

8. **MEDICAL SURVEILLANCE.**

a. Applicability of medical surveillance. 29 CFR 1910.120 defines requirements for a medical surveillance program, including personnel to be included in the program, frequency of medical examinations, contents of medical examinations, and recordkeeping requirements. Medical surveillance requirements apply to the following personnel:

(1) All employees who are or may be exposed to hazardous substances at or above the permissible exposure limits for 30 days or more a year;

(2) All employees who wear a respirator;

(3) All employees who are injured due to overexposure from an emergency incident involving hazardous substances or health hazards; and

(4) Members of HAZMAT teams.

b. Frequency of medical examinations and consultations. Medical examinations/consultations must be made available by the activity to each worker covered under paragraph 8.a. above on the following schedules:

(1) For individuals who fall under sections 8.a.(1), 8.a.(2) or 8.a.(4) above:

(a) Prior to assignment;

(b) At least once every twelve months;

(c) At termination of employment or reassignment;

(d) As soon as possible upon notification that the worker has developed signs or symptoms indicating possible overexposure or has been injured or exposed above the permissible exposure limits in an emergency situation; and

(e) More frequently if the physician feels it is necessary.

(2) Other individuals. This includes workers who are under Section 8.a.(3), workers who may have been injured, developed signs or symptoms from exposures to hazardous substances from emergency incidents, or those exposed during an emergency incident to hazardous substances above the permissible exposure limits without the necessary PPE being used.

(a) As soon as possible following the emergency incident or development of signs or symptoms.

(b) At additional times, if the examining physician determines that follow-up exams or consultations are medically necessary.

9. **ENGINEERING CONTROLS AND WORK PRACTICES FOR EMPLOYEE PROTECTION.**

a. Engineering controls and work practices for regulated substances. Engineering controls and work practices must be instituted to reduce and maintain exposure below the permissible exposure limits regulated in 29 CFR 1910, Subpart G (Occupational Health and Environmental Control) and Subpart Z (Toxic and Hazardous Substances).

> **NOTE:** The employer cannot rotate employees on a schedule as a means of compliance with the standards except when there is no other feasible way of complying with the airborne or dermal dose limits (e.g., ionizing radiation).

b. Engineering controls and work practices for non-regulated substances. Use an appropriate combination of engineering controls and work practices to reduce and maintain worker exposure below published exposure levels for hazardous substances not regulated by 29 CFR 1910, Subparts G (Occupational Health and Environmental Control) and Z (Toxic and Hazardous Substances). Use published literature and MSDS.

10. **INFORMATIONAL PROGRAMS.** As part of the safety and health program, employers must implement a program to inform employees and contractors actually engaged in hazardous waste operations. Information includes the nature, level, and degree of exposure as a result of participation in such hazardous waste operations.

11. **HANDLING DRUMS AND CONTAINERS.**

a. General requirements. Hazardous substances and contaminated soils, liquids, and other residues must be handled, transported, labeled, and disposed of using the following requirements:

(1) Drums and containers used during the clean-up must meet the proper DOT, OSHA, and EPA regulations for the wastes they contain.

(2) When practical, drums and containers must be inspected and their integrity assured prior to being moved.

(3) Drums or containers that cannot be inspected before being moved because of storage conditions (i.e., stacked behind other drums) must be moved to an accessible location and inspected prior to further handling.

(4) Unlabeled drums/containers must be considered to contain hazardous substances and handled accordingly until the contents are positively identified and labeled.

(5) Site operations must be organized to minimize the amount of drum/container movement.

(6) Prior to movement of drums or containers, all individuals involved in this task must be warned of the potential hazards associated with their contents.

(7) DOT specified salvage drums or containers and spill kits must be made available where spills, leaks, or ruptures may occur.

(8) A spill containment program (for major spills), which is part of the safety and health program must be implemented to contain and isolate the entire volume of the material being transferred.

(9) Drums and containers that cannot be moved without rupture, leakage, or spillage must be emptied into a container classified for the material being transferred.

(10) Some form of detection system must be used to estimate the location and depth of buried drums or containers.

(11) Soil or covering material must be removed from buried drums/containers with caution to prevent drum/container rupture.

(12) Fire extinguishing equipment meeting the requirements of 29 CFR 1910, Subpart L (Fire Protection) must be on hand and ready for use to control fires.

b. Drum/container opening. Opening drums and containers must be done by the following procedures:

(1) If an airline respirator is worn, the entire system must be protected from contamination and physical damage.

(2) Keep those individuals not actually involved in opening drums or containers a safe distance away.

(3) If individuals must work near drums/containers being opened, a suitable shield must be placed between the employees and the drums being opened to protect personnel in case of accidental explosion.

(4) Safety equipment, monitoring equipment, and machinery must be kept behind the explosion proof barrier.

(5) Use spark proof hand tools and material handling equipment.

(6) Safely relieve internal pressure (i.e., vent the drum by opening the pressure relief valve) of drums/containers when opening them. If this is not possible, shielding must be placed between the employee and drum to prevent injury.

(7) Workers must not stand on drums or containers.

c. Material handling equipment. Material handling equipment used to transfer drums/containers must be selected and used to minimize sources of ignition.

d. Radioactive wastes. Drums/containers containing radioactive wastes must not be approached or handled until such time as their hazard to workers is properly assessed.

e. Shock sensitive wastes. Use the following precautions when handling shock sensitive wastes:

(1) Evacuate non-essential employees from the area of transfer;

(2) Provide material handling equipment with explosive containment devices or protective shields to protect equipment operators from exploding containers;

(3) An alarm system capable of being detected above ambient light and noise conditions must be used to signal the start and finish of explosive waste handling activities;

(4) Continuous communications (e.g., portable radios) must be maintained between the worker-in-charge of the handling area, the supervisor, and the command post. Do not use communication equipment that could cause shock sensitive materials to explode;

(5) Do not move bulging or swelling containers until the cause for the pressure is determined and containment procedures have been implemented to protect employees from explosive relief of the drum; and

(6) Treat laboratory waste drums as shock sensitive until they have been characterized.

f. Laboratory waste packs.

(1) Lab packs must be opened only when necessary by individuals knowledgeable in the inspection, classification, and segregation of the containers within the pack; and

(2) If crystalline material is noted on any container, the contents must be handled as a shock sensitive waste until the contents are identified.

g. Sampling of drum/container contents. Sampling of drum and container contents must be done with a sampling procedure which is part of the site safety and health plan.

h. Shipping and transport.

(1) Drums and containers must be identified and classified prior to packaging for transport.

(2) Staging areas for drums or containers must be kept to the minimum necessary to identify and classify materials.

(3) Adequate access and egress routes must be provided for staging areas.

12. **DECONTAMINATION.**

a. Decontamination procedures.

(1) A decontamination procedure must be developed, communicated to employees and implemented before any workers or equipment enter areas on site where potential for exposure to hazardous substances exists.

(2) Standard operating procedures must be developed to minimize worker contact with hazardous substances or equipment that may be contaminated by hazardous substances.

(3) All employees leaving a contaminated area must be appropriately decontaminated. All contaminated clothing and equipment leaving a contaminated area must be appropriately disposed of or decontaminated.

(4) Decontamination procedures must be monitored by the site safety and health supervisor.

b. Location. Decontamination must be performed in geographical areas that will minimize exposure to uncontaminated employees or equipment.

c. Equipment/solvents. Equipment and solvents used for decontamination must be decontaminated or disposed of properly.

d. Personal protective clothing and equipment.

(1) These items must be decontaminated, cleaned, laundered, maintained, or replaced as needed.

(2) Workers whose permeable clothing becomes contaminated with hazardous substances must immediately remove that clothing and proceed to the shower. The clothing must be disposed of or decontaminated before it is removed from the work zone.

e. Cleaning establishments. Commercial laundries or cleaning establishments that decontaminate protective clothing or equipment must be informed of the potentially harmful effects of exposures to hazardous substances.

f. Showers and change rooms. Where the decontamination procedure requires showers and change rooms outside of a contaminated area, they must be provided and meet the requirements of 29 CFR 1910.141 (Sanitation).

13. **ILLUMINATION.** 29 CFR 1910.120 lists the minimum illumination intensities that must be provided in areas accessible to employees.

14. **SANITATION AT TEMPORARY WORKPLACES.** 29 CFR 1910.120 lists the requirements for potable water, nonpotable water, toilet facilities, food handling, sleeping quarters, washing facilities, and showers and change rooms.

15. **EMERGENCY RESPONSE TO HAZARDOUS SUBSTANCE RELEASES.**

a. Emergency response plan. An emergency response plan must be developed and implemented to handle anticipated emergencies prior to the commencement of hazardous waste operations.

(1) The plan must be in writing and available for inspection and copying by workers, their representatives, and OSHA personnel.

(2) Activities who evacuate their workers from the workplace when an emergency occurs or who do not permit any of their workers to assist in handling the emergency are exempt from

the above if they provide an emergency action plan which follows 29 CFR 1910.38(a) (Emergency Action Plan).

b. Elements of an emergency response plan.

(1) Pre-emergency planning and coordination with outside parties.

(2) Personnel roles, lines of authority, training, and communication.

(3) Site mapping.

(4) Emergency recognition and prevention.

(5) Safe distances and places of refuge.

(6) Site security and control.

(7) Evacuation routes and procedures.

(8) Decontamination procedures.

(9) Emergency medical treatment and first aid.

(10) Emergency alerting and response procedures.

(11) Critique of response and follow-up.

(12) PPE and emergency equipment.

c. Procedures for handling emergency response. The following must also be included in the emergency response plan:

(1) Site topography, layout, and prevailing weather conditions.

(2) Procedures for reporting incidents to local, state and federal governmental agencies.

(3) The emergency response plan should be a separate section of the Site Safety and Health Plan.

(4) The emergency response plan should be compatible with the disaster, fire, and/or emergency response plans of local, state, and federal agencies.

(5) The emergency response plan should be rehearsed regularly as part of the overall training program for site operations.

(6) The emergency response plan should be reviewed periodically and, as necessary, be amended to keep it current with new or changing site conditions or information.

(7) An emergency alarm system should be installed per 29 CFR 1910.165 (Employee Alarm Systems) to notify workers of an emergency situation; to stop work activities if necessary; to lower background noise in order to speed communication; and to begin emergency procedures.

(8) Based upon the information available at the time of the emergency, the activity should evaluate the incident and the site response capabilities and proceed with the appropriate steps to implement the site emergency response plan.

(9) Incident Command System.

(a) The senior emergency response official must assume charge of a site-specific Incident Command System (ICS) as the on scene or incident commander (OSC or IC). All emergency responders and their communications must be coordinated and controlled through the OSC/IC with assistance from the senior official present for each activity.

> **NOTE**: The "senior official" at an emergency response is the most senior official on the site who has the responsibility for controlling the operations at the site. Initially, it is the senior officer on the first-due piece of responding emergency apparatus to arrive on the incident scene. As more senior officers (i.e., battalion chief, fire chief, etc.) arrive, the position is passed up the line of authority.

(b) To the extent possible, the OSC/IC must identify all hazardous substances or conditions present and address, as appropriate, site analysis, use of engineering controls, maximum exposure limits, and hazardous substance handling procedures.

(c) Based on the hazardous substances and/or conditions present, the OSC/IC must implement appropriate emergency operations, and assure that PPE worn is appropriate for the hazards to be encountered.

(d) Individuals engaged in emergency response and exposed to hazardous substances presenting an inhalation hazard or potential inhalation hazard must wear positive pressure SCBA while engaged in emergency response, until such time that the OSC/IC determines through the use of air monitoring that a decreased level of respiratory protection will not result in hazardous exposures to workers.

(e) The OSC/IC must limit the number of emergency response personnel to those performing emergency operations at the site and in those areas of potential or actual exposure to incident or site hazards. However, operations in hazardous areas must be performed using the buddy system in groups of two or more.

(f) Back-up personnel must stand by with equipment ready to provide assistance or rescue. Advanced first aid support personnel must also stand by with medical equipment and transportation capability.

(g) The OSC/IC must designate a safety official who is knowledgeable in the operations being implemented at the emergency response site, with specific responsibility to identify and evaluate hazards and to provide direction with respect to the safety of operations for the emergency at hand.

(h) When activities are judged by the safety official to be in IDLH conditions and/or to involve an imminent danger condition, the safety official must have the authority to alter, suspend, or terminate those activities. He must immediately inform the OSC/IC of any actions necessary to correct the hazards.

(i) After emergency operations have terminated, the OSC/IC must implement appropriate decontamination procedures.

d. Skilled support personnel. Individuals, not necessarily an activity's own employees, who are skilled in the operation of certain equipment, such as digging equipment, and who are needed to perform immediate emergency support work that cannot reasonably be performed in a timely fashion by an activity's own workers, and who will be or may be exposed to the hazards at an emergency response scene, are not required to receive the intensive training required for the activity's regular employees. However, these employees must be given an initial briefing at the site prior to their participation in any emergency response. The initial briefing must include the following:

(1) Instruction in wearing appropriate PPE;

(2) What chemical hazards are involved; and

(3) What duties are to be performed.

e. Specialist workers. Personnel who, in the course of their job duties, work with and are trained in the hazards of specific hazardous substances, and who will be called upon to

provide assistance at a hazardous substance release incident to the OSC/IC, must receive training or demonstrate competency in the area of their specialization annually.

f. Training. This must be based on the duties and function to be performed by each responder of an emergency organization. The skills and knowledge required for all new responders must be conveyed to them through training prior to taking part in actual emergency operations. 29 CFR 1910.120 establishes the duties of each responder and the training required for each of these individuals prior to taking part in actual emergency operations and periodic refresher training. It also establishes requirements for trainers.

g. Medical surveillance and consultation.

(1) HAZMAT team/hazardous materials specialists. Members of an organized and designated HAZMAT team and hazardous materials specialists must receive a baseline physical examination and be provided with medical surveillance as required in section 8 of this chapter.

(2) Medical consultation. Any emergency response employees who exhibit signs or symptoms which may have resulted from exposure to hazardous substances during the course of an emergency incident, either immediately or subsequently, must be provided with medical consultation.

h. Chemical protective clothing. Chemical protective clothing and equipment to be used by organized and designated HAZMAT team members, or to be used by hazardous materials specialists, must meet the requirements of section 5 of this chapter.

i. Post-emergency response operations. Upon completion of the emergency response, if it is determined that it is necessary to remove hazardous substances, health hazards, and materials contaminated with them (i.e., contaminated soil) from the site of the incident, the activity conducting the clean-up must comply with one of the following:

(1) Requirements. Meet all the requirements of sections 3 through 14 of this chapter; or

(2) Clean-up. Where the clean-up is done on the plant property using plant or workplace employees, such individuals must have completed the training requirements of the following: 29 CFR 1910.38(a) (Emergency Action Plan), 29 CFR 1010.134 (Respiratory Protection) and 29 CFR 1910.1200 (Hazard Communication). All equipment to be used in the performance of

the clean-up work must be in serviceable condition and must have been inspected prior to use.

Table 12-1. Health and Safety Program:
Comprehensive and Site-Specific Components

Comprehensive Health and Safety Program	**Site-Specific HASP**
The HAZWOPER regulations in 29 CFR 1910.120(b)(1) require a comprehensive health and safety program that includes:	*The HASP implements certain components of the health and safety program on a site-specific basis. The HASP includes:*
• Organizational structure • Site-specific workplaces	• Key personnel • Health and safety risk analysis • Site control measures • Training assignments
• Site-specific health and safety plans (HASPs)	• Medical surveillance requirements
• Health and safety training program • Medical surveillance program • Standard operating procedures • Coordination procedures	• Personal protective equipment • Air and employee monitoring • Spill containment program • Confined space procedures • Decontamination procedures • Emergency response plan

Source: Adapted from *Standard Operating Safety Guides*, EPA Publication 9285.1-03 (1992).

Table 12-2. Atmospheric Hazard Action Guides

Monitoring Equipment	Atmospheric Hazard	Level	Action
Combustible Gas Indicator	Explosive	< 10% LEL[b]	Continue monitoring with caution.
		10-25% LEL	Continue monitoring, but with extreme caution, especially as higher levels are encountered.
		> 25% LEL	Explosion hazard! Withdraw from area immediately.
Oxygen Level		< 19.5%	Monitor wearing SCBA. NOTE: Combustible gas readings not valid in atmospheres with less than 19.5% oxygen.
		19.5-25%	Continue monitoring with caution. SCBA not needed based only on oxygen content.
		> 25%	Discontinue monitoring. Fire potential! Consult specialist.
Radiation Survey Equipment	Gamma Radiation	Above background: < 1 mR/hr	Continue monitoring. Consult a health physicist.
		1 mR/hr	Withdraw. Continue monitoring only upon the advice of a health physicist.
Colorimetric Tubes	Organic & Inorganic Vapors/Gases	Depends on chemical	Consult reference manuals for air concentration vs. PEL/TLV and toxicity data.
Photoionization Detector	Organic Vapor/Gases	Depends on chemical	Consult reference manuals for air concentration vs. PEL/TLV and toxicity data.
Flame Ionization Detector	Organic Vapor/Gases	Depends on chemical	Consult reference manuals for air concentration vs. PEL/TLV and toxicity data.

Source: Adapted from *Standard Operating Safety Guidelines*, EPA Publication 9285.1-03 (1992).

[a] NOTE: Hazard classes are general, and not all compounds in these classes can be measured by real time instruments.

[b] LEL = Lower explosive limit

Table 12-3. Some Direct Reading Instruments for General Survey.

Instrument	Hazard Monitored	Application	Detection Method	Limitations	Ease of Operation	General Care and Maintenance	Typical Operating Times
Combustible Gas Indicator (CGI)	Combustible gases and vapors	Measures the concentration of combustible gas or vapor.	A filament, usually made of platinum, is heated by burning the combustible gas or vapor. The increase in heat is measured.	Accuracy depends, in part, on the difference between the calibration and sampling temperatures. Sensitivity is a function of the differences in the chemical and physical properties between the calibration gas and the gas being sampled. The filament can be damaged by certain compounds such as silicones, halides, tetraethyl lead, and oxygen enriched atmospheres. Does not provide a valid reading under oxygen deficient conditions.	Effective use requires that operator understand the operating principles and procedures.	Recharge or replace battery. Calibrate immediately before use.	Can be used as long as the battery lasts, or for the recommended interval between calibrations, whichever is less.
Gamma Radiation Survey Instrument	Gamma radiation	Environmental radiation monitor	Scintillation detector	Does not measure alpha or beta radiation.	Extremely easy to operate, but requires experience to interpret data. Rugged, good in field use.	Must be calibrated annually at a specialized facility.	Can be used as long as the battery lasts, or for the recommended interval between calibrations, whichever is less.

Table 12-3. Some Direct Reading Instruments for General Survey, *continued*.

Instrument	Hazard Monitored	Application	Detection Method	Limitations	Ease of Operation	General Care and Maintenance	Typical Operating Times
Oxygen Meter	Oxygen (O_2)	Measures the percentage of O_2 in air.	Uses an electrochemical sensor to measure the partial pressure of O_2 in the air and converts that reading to O_2 concentration.	Must be calibrated prior to use to compensate for altitude and barometric pressure. Certain gases, especially oxidants such as ozone, can affect readings. Carbon dioxide (CO_2) poisons the detector cell.	Effective use requires that the operator understand the operating principles and procedures.	Replace detector cell according to manufacturer's recommendations. Recharge or replace batteries prior to expiration of the specified interval. If the ambient air is more than 0.5% CO_2, replace or rejuvenate the O_2 detector cell frequently.	8 to 12 hours
Direct Reading Colorimetric Indicator Tube	Specific gases and vapors	Measures concentrations of specific gases and vapors.	The compound reacts with the indicator chemical in the tube, producing a stain whose length or color change is proportional to the compound's concentration.	The measured concentration of the same compound may vary among different manufacturers' tubes. Many similar chemicals interfere. Greatest sources of error are how the operator judges stain's end point and the tubes' limited accuracy. Affected by high humidity.	Minimal operator training and expertise required.	Store tubes in refrigerator to maintain shelf life (about 2 years). Check expiration date before use. Do not use previously opened tubes, even if the indicator chemical is not stained. Avoid rough handling, which may cause channeling. Check pump for leaks before and after use. Calibrate pump quarterly.	

Table 12-3. Some Direct Reading Instruments for General Survey, *continued*.

Instrument	Hazard Monitored	Application	Detection Method	Limitations	Ease of Operation	General Care and Maintenance	Typical Operating Times
Portable Infrared (IR) Spectrophotometer	Many gases and vapors	Measures concentration of many gases and vapors in air. Designed to quantify one- or two-component mixtures.	Passes different frequencies of IR through the sample. The frequencies absorbed are specified for each compound.	In the field, must make repeated passes to achieve reliable results. Requires 115-volt, AC power. Not approved for use in potentially flammable or explosive atmospheres. Interference by water vapor and carbon dioxide. Certain vapors and high moisture may attack the instrument's optics, which must then be replaced.	Requires personnel with extensive experience in IR spectrophotometry.	As specified by manufacturer.	
Ultraviolet (UV) Photoionization Detector (PID)	Many organic and some inorganic gases and vapors	Detects total concentrations of many organic and some inorganic gases and vapors. Some identification of compounds is possible if more than one probe is used.	Ionizes molecules using UV radiation; produces a current that is proportional to the number of ions.	Does not detect methane. Does not detect a compound if the probe used has a lower energy level than the compound's ionization potential. Response may change when gases are mixed.	Effective use requires that the operator understand the operating principles and procedures, and be competent in calibrating, reading, and interpreting the instrument.	Recharge or replace battery. Regularly clean lamp window. Regularly clean and maintain the instrument and accessories.	10 hours; 5 hours with strip chart recorder.

Table 12-3. Some Direct Reading Instruments for General Survey, *continued*.

Instrument	Hazard Monitored	Application	Detection Method	Limitations	Ease of Operation	General Care and Maintenance	Typical Operating Times
Ultraviolet (UV) Photoionization Detector (PID) Cont'd				Other voltage sources may interfere with measurements. Readings can only be reported relative to the calibration standard used. Response is affected by high humidity.			
Flame Ionization Detector (FID) with Chromatography Option	Many organic gases and vapors	In survey mode, detects the total concentrations of may organic gases and vapors. In gas chromatography (GC) mode, identifies and measures specific compounds. In survey mode, all the organic compounds are ionized and detected the same time. In GC mode, volatile species are separated.	Gases and vapors are ionized in a flame. A current is produced in proportion to the number of carbon atoms present.	Does not detect inorganic gases and vapors or some synthetics. Sensitivity depends on the compound. Should not be used at temperatures less than 40 F (4 C). Difficult to absolutely identify compounds. High concentrations of contaminants or oxygen-deficient atmospheres require system modification. In survey mode, readings can only be reported relative to the calibration standard used.	Requires experience to interpret data correctly, especially in GC mode. Specific identification requires calibration with the specific analyte of interest.	Recharge or replace battery. Monitor fuel and/or combustion air supply gauges. Perform routine maintenance as described in the manual. Check for leaks.	8 hours; 3 hours with strip chart recorder.

Table 12-4. Initial Site Entry: Visual Inspection Checklist.

Source: Adapted from *Standard Operating Safety Guides*, EPA Publication 9285.1-03 (1992).

Note the types of containers, impoundments, or other storage systems:

-- Paper or wood packages.
-- Metal or plastic barrels or drums.
-- Underground tanks.
-- Aboveground tanks.
-- Compressed gas cylinders.
-- Pits, ponds, or lagoons.

Note any tags, labels, markings, or other identifying indicators.

Note the condition of waste containers and storage systems:

-- Sound (undamaged).
-- Visibly rusted or corroded.
-- Leaking or bulging.
-- Size and type of container.
-- Labels on containers indicating corrosive, explosive, flammable, radioactive, toxic materials.

Note the physical condition of the materials:

-- Gas, liquid, or solid.
-- Color and turbidity.
-- Behavior, e.g., corroding, foaming, vaporizing, or crystallizing.
-- Conditions conducive to splash or contact.

Identify natural wind barriers:

-- Buildings.
-- Fences.
-- Vegetation.

Determine the potential pathways of dispersion:

-- Air.
-- Biologic routes, such as animals and food chains.
-- Ground water.
-- Land surface
-- Surface water.

Note any indicators of potential exposure to hazardous substances:

-- Dead fish, animals or vegetation.
-- Dust or spray in the air.
-- Fissures or cracks in solid surfaces that exposure deep waste layers.
-- Pools of liquid.
-- Gas generation or effervescence.
-- Deteriorating containers.
-- Cleared land areas or possible landfilled areas.
-- Subsiding areas indicating waste burial locations.

Note any safety hazards. Consider:

-- Conditions of site structures.
-- Obstacles to entry and exit.
-- Terrain homogeneity.
-- Terrain stability.
-- Stability of stacked material.

Identify any reactive, incompatible, flammable, or highly corrosive wastes.

Note land features.

Note the presence of any potential naturally occurring skin irritants or dermatitis-inducing agents, for example:

-- Poison ivy.
-- Poison oak.
-- Poison sumac.

Collect samples:

-- Air.
-- Drainage ditches.
-- Soil (surface and subsurface).
-- Standing pools of liquids.
-- Storage containers.
-- Streams and ponds.
-- Ground water (upgradient, beneath site, downgradient).

APPENDIX 12-A

ADDITIONAL SOURCES OF INFORMATION

PUBLISHED RESOURCES

American Conference of Governmental Industrial Hygienists. *Guidelines for the Selection of Chemical Protective Clothing.* 3rd ed. Cincinnati: ACGIH. 1987.

American Conference of Governmental Industrial Hygienists (ACGIH). *1995-1996 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.* Cincinnati, OH: ACGIH. 1995.

Budavari, S., ed.: *The Merck Index.* 11th ed. Rahway: Merck & Company, Inc. 1989.

Lewis, R. J., Sr.: *Hawley's Condensed Chemical Dictionary*. New York: Van Nostrand Reinhold Company. 1993.

National Fire Protection Association. *Fire Protection Guide on Hazardous Materials.* 10th ed. Quincy: National Fire Protection Association, 1991.

National Institute for Occupational Safety and Health (NIOSH)/Occupational Safety and Health Administration (OSHA)/U. S. Coast Guard (USCG)/U. S. Environmental Protection Agency (EPA). *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities.* DHHS (NIOSH) Pub. No. 85-115. Washington, DC: U.S. Government Printing Office. 1985.

National Institute for Occupational Safety and Health/Occupational Safety and Health Administration. *Occupational Safety and Health Guidelines for Chemical Hazards.* Supplement II-OHG. DHHS (NIOSH) Pub. 89-104.Cincinnati, OH: U. S. Department of Health and Human Services. 1989.

National Institute for Occupational Safety and Health. *NIOSH Pocket Guide to Chemical Hazards*. NIOSH Pub. 94-116. Cincinnati, OH: U.S. Department of Health and Human Services. 1994.

OSHA. Toxic and Hazardous Substances. Code of Federal Regulations, Title 29, Part 1910, Subpart Z. 1994.

U.S. Department of Transportation (DOT). *1993 Emergency Response Guidebook.* DOT Research and Special Programs Administration (RSPA) Pub. P5800.6. Washington, DC: U.S. Government Printing Office. 1993.

U.S. Environmental Protection Agency. *Office of Solid Waste and Emergency Response Integrated Health and Safety Program Standard Operating Practices for OSWER Field Activities.* OSWER Pub. 9285.0-01A. Washington, DC: U.S. Environmental Protection Agency. 1992.

U.S. Environmental Protection Agency. *Standard Operating Safety Guides*. EPA Pub. 9285.1-03. Washington, DC: U.S. Environmental Protection Agency. 1992.

U. S. Environmental Protection Agency. *Health and Safety Planner (HASP) Users Guide*. EPA Pub. 9285.8-01. Washington, DC: U.S. Environmental Protection Agency. 1993.

TELEPHONE RESOURCES

Chemical Emergency Preparedness Program (CEPP) Information. Access at (800) 535-0202.

Chemical Referral Center (CRC). Access at (800) 262-8200.

Chemical Transportation Emergency Center (CHEMTREC), telephone: (800) 424-9300 or (202) 483-9300.

APPENDIX 12-A

ADDITIONAL SOURCES OF INFORMATION, *continued*

U.S. Coast Guard. CHRIS: Chemical Hazard Response Information System. Access through National Response Center, telephone: (800) 424-8802.

COMPUTER RESOURCES

National Institute for Occupational Safety and Health. Registry of Toxic Effects of Chemical Substances (RTECS). Hamilton, Ontario, Canada: Canadian Centre for Occupational Health and Safety. CD ROM Issue 95-3. 1995.

Naval Supply Systems Command: Hazardous Material Control and Management (HMC&M)/ Department of Defense: Hazardous Materials Information System (HMIS). Navy Computer and Telecommunications Area Master Station, Atlantic (NCTAMSLANT). CD ROM, latest revision July 1995.

U.S. Environmental Protection Agency. Oil and Hazardous Materials Technical Assistance Data System (OHMTADS). Access through U.S. EPA Regional Offices.

APPENDIX 12-B

Components of the Health and Safety Plan (HASP)

Source: Adapted from Standard Operating Safety Guidelines, EPA Publication 9285.1-03, 1992.

Key Personnel and Hazard Communications Plan (29 CFR 1910.120(b)(2))	The HASP should include names of key personnel such as Project Manager, Field Operations Leader, Site Supervisor, and Site Health and Safety Officer, as well as their alternates. The HASP should also identify communication procedures and provide for briefings to be held before site activity is initiated. These meetings should be held at any time they appear necessary to ensure that employees are adequately apprised of the health and safety procedures being followed at the site.
Health and Safety Risk Analysis (29 CFR 1910.120(b)(4))	Health and safety risk analyses should be established for each task and operation identified in the site-specific workplan. Discussion of these analyses should include identification of chemical contaminants, affected media, concentrations, and potential routes of exposure for use in risk analysis. Should also include safety risk analyses to address anticipated on site operations and safety problems.
Site Control Measures (29 CFR 1910.120(d))	The site control program in the HASP specifies the procedures that will be used to minimize employee exposure to hazardous substances before cleanup operations commence and during site operations. The program must be developed during the planning stages of a hazardous waste cleanup operation, and must be modified as any new information becomes available. The site control program should include a site map, designation of work zones, site communications, safety work practices, identification of the nearest medical assistance, and description of the "buddy system" for site operations.
Employee Training Assignments (29 CFR 1910.120(e))	Training assignments should address the employee's initial health and safety training, annual health and safety refresher training, on-the-job training, supervisory training, and first-aid and CPR training. Employees should not be permitted to participate in or supervise field activities until they have received training commensurate with their responsibilities.
Medical Surveillance (29 CFR 1910.120(f))	The medical surveillance program is required for monitoring the health status of personnel who are potentially exposed to hazardous substances in the field and who wear respirators 30 days or more per year. It must include initial and periodic medical examinations, examination upon termination or employment, and medical recordkeeping.

APPENDIX 12-B

Components of the Health and Safety Plan (HASP), *continued*

Personal Protective Equipment (PPE) (29 CFR 1910.120(g))	The HASP must describe the different PPE ensembles that will be used to address potential hazards during site activities. The HASP should also include or refer to a comprehensive PPE program that addresses site hazards, duration of site activities, limitations of PPE during temperature extremes, PPE selection, maintenance, storage, and decontamination, and training for PPE use, inspection and monitoring. Such PPE should be used only when engineering controls and work practices are insufficient to adequately protect against exposure.
Air and Personal Monitoring (29 CFR 1910.120(h))	The HASP must describe the employee and air monitoring equipment and environmental sampling techniques and instrumentation that will be used on-site for evaluating potential exposure to contaminants that result from site activities. The monitoring program must include procedures for initial entry monitoring, periodic monitoring, and monitoring of high risk employee.
Spill Containment Program (29 CFR 1910.120(j))	The HASP should include any elements of the spill containment program that may be relevant to the site, and should provide procedures to contain and isolate the entire volume of any hazardous substance spilled in the course of a transfer, major spill or an on site release.
Confined Space Entry Procedures (29 CFR 1910.120(b)(9))	If confined space entry is anticipated on site, the HASP should describe procedures for entry into confined space. Such procedures ensure the safety of site personnel who must enter areas where natural ventilation is insufficient to reduce contaminant concentrations.
Decontamination Procedures (29 CFR 1910.120(k))	The HASP should include decontamination procedures, both for individuals and equipment on site and in places where there is a potential for exposure to a hazardous substance. These procedures should explain how to minimize contact with hazardous substances and how to conduct personal and equipment decontamination when leaving a contaminated area.
Emergency Response Plan (29 CFR 1910.120(l))	The emergency response plan in the HASP must include a description of how anticipated emergencies would be handled at the site and how the risks associated with a response would be minimized. The emergency response plan must be developed and implemented prior to beginning site operations.

APPENDIX 12-B

Sample HASP Table of Contents for Site "A"

APPENDIX 12-B

Sample HASP Table of Contents for Site "A", *continued*

EPA HASP Version 3.0: This sample HASP Table of Contents reflects specific health and safety considerations for Site "A." Other sites may address different topics in the HASP, subject to site-specific hazards and activities.

APPENDIX 12-C

Sample Protective Ensembles Based on EPA Protective Ensembles

LEVEL OF PROTECTION A

Equipment	Protection Provided	Should Be Used When:	Limiting Criteria
RECOMMENDED: • Pressure-demand, full-facepiece SCBA or pressure-demand supplied-air respirator with escape SCBA. • Fully-encapsulating, chemical-resistant suit. • Inner chemical-resistant gloves. • Chemical resistant safety boots/ shoes. • Two-way radio communications. **OPTIONAL:** Hard hat. Coveralls. Cooling unit. Long cotton underwear. Disposable gloves and boot covers.	The highest available level of respiratory, skin, and eye protection.	1. The chemical substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on either: - measured (or potential for) high concentration of atmospheric vapors, gases, or particulates; or - site operations and work functions involving a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates of materials that are harmful to skin or capable of being absorbed through the intact skin. 2. Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible. 3. Operations must be conducted in confined, poorly ventilated areas until the absence of conditions requiring Level A protection is determined.	Fully encapsulating suit material must be compatible with the substances involved.

LEVEL OF PROTECTION B

Equipment	Protection Provided	Should Be Used When	Limiting Criteria
RECOMMENDED: • Pressure demand, full-facepiece SCBA or pressure-demand supplied-air respirator with escape SCBA. • Chemical-resistant clothing (over-alls and long-sleeved jacket; hooded, one- or two-piece chemical splash suit; disposable chemical-resistant one-piece suit). • Inner and outer chemical-resistant gloves. • Chemical-resistant safety boots/ shoes. • Hard hat. • Two-way radio communications. **OPTIONAL:** Coveralls. Face shield. Disposable boot covers. Long cotton underwear.	The same level of respiratory protection, but less skin protection than Level A. It is the minimum level recommend-ed for initial site entries until the hazards have been further identified.	1. The type and atmospheric concentration of substances have been identified and require a high level of respiratory protection, but less skin protection. This involves atmospheres: - with IDLH concentrations of specific substances that do not represent a skin hazard: or - that do not meet the criteria for use of air-purifying respirators. 2. Atmosphere contains less than 19.5% oxygen. 3. Presence of incompletely identified vapors or gases is indicated by direct-reading organic vapor detection instrument, but vapors and gases are not suspected of containing high levels of chemicals harmful to skin or capable of being absorbed through the intact skin.	Use only when the vapor or gases present are not suspected or containing high concentrations of chemicals that are harmful to skin or capable of being absorbed through the intact skin.

APPENDIX 12-C

Sample Protective Ensembles Based on EPA Protective Ensembles

LEVEL OF PROTECTION C

Equipment	Protection Provided	Should Be Used When	Limiting Criteria
RECOMMENDED: • Full-facepiece, air-purifying, canister equipped respirator. • Chemical-resistant clothing (overalls and long-sleeved jacket; hooded, one- or two-piece chemical splash suit; disposable chemical-resistant one-piece suit). • Inner and outer chemical-resistant gloves. • Chemical-resistant safety boots/ shoes. • Hard hat. • Two-way radio communications. **OPTIONAL:** Coveralls. Face shield. Disposable boot covers. Long cotton underwear. Use of escape mask during initial entry is optional only after characterization (29 CFR 1910.120(c)(5)(ii)).	The same level of skin protection as Level B, but a lower level of respiratory protection.	1. The atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect any exposed skin. 2. The types of air contaminants have been identified, concentrations measured, and a canister is available that can remove the contaminant. 3. All criteria for the use of air-purifying respirators are met.	Atmospheric concentration of chemicals must not exceed IDLH levels. The atmosphere must contain at least 19.5% oxygen.

LEVEL OF PROTECTION D

Equipment	Protection Provided	Should Be Used When	Limiting Criteria
RECOMMENDED: • Coveralls. • Safety boots/shoes. • Safety glasses or chemical splash goggles. • Hard hat. **OPTIONAL:** Gloves. Escape mask. Face shield.	No respiratory protection. Minimal skin protection.	1. The atmosphere contains no known hazard. 2. Work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.	This level should not be worn in the Exclusion Zone. The atmosphere must contain at least 19.5% oxygen.

APPENDIX 12-D[1]

Sample Hazardous Substance Information Form

COMMON NAME: _____ CHEMICAL NAME:_____

I. PHYSICAL/CHEMICAL PROPERTIES

		SOURCE
Natural physical state: Gas _____	Liquid _____ Solid _____	
(at ambient temps of 20 -25 C)		
Molecular weight	_____ g/g-mole,	_____
Density[a]	_____ g/ml	_____
Specific gravity[a]	_____@_____ F/ C	_____
Solubility: water	_____@_____ F/ C	_____
Solubility[b]: _____	_____@_____ F/ C	_____
Boiling point	_____ F/ C	_____
Melting point	_____ F/ C	_____
Vapor pressure	_____mmHg@_____ F/ C	_____
Vapor density	_____@_____ F/ C	_____
Flash point	_____ F/ C	_____
(open cup _____;		
closed cup _____)		
Other: _____	_____	_____

II. HAZARDOUS CHARACTERISTICS

A. TOXICOLOGICAL HAZARD	HAZARD?	CONCENTRATIONS (PEL, TLV, other)	SOURCE
Inhalation	Yes No	_____	_____
Ingestion	Yes No	_____	_____
Skin/eye absorption	Yes No	_____	_____
Skin/eye contact	Yes No	_____	_____
Carcinogenic	Yes No	_____	_____
Teratogenic	Yes No	_____	_____
Mutagenic	Yes No	_____	_____
Aquatic	Yes No	_____	_____
Other:_____	Yes No		

B. FLAMMABILITY HAZARD	HAZARD?	CONCENTRATIONS _____	SOURCE _____
Combustibility	Yes No		
Toxic byproducts:	Yes No	_____	_____
_____		_____	_____
_____			
Flammability	Yes No	_____	_____
LFL		_____	_____
UFL			
Explosivity	Yes No	_____	_____
LEL		_____	_____
UEL			

[1] Adapted from Standard Operating Safety Guides, EPA Publication 9285.1-03, 1992.
[a] Only one is necessary.
[b] For organic compounds, recovery of spilled material by solvent extraction may require solubility data.

APPENDIX 12-D[1]

Sample Hazardous Substance Information Form, *continued*

C. REACTIVITY HAZARD	HAZARD?	CONCENTRATIONS	SOURCE
Reactivities:	Yes No		
_____		_____	_____
_____		_____	_____

D. CORROSIVITY HAZARD	HAZARD?	CONCENTRATIONS	SOURCE
pH _____	Yes No		_____
Neutralizing agent:			
_____		_____	_____
_____		_____	_____

E. RADIOACTIVE HAZARD	HAZARD?	EXPOSURE RATE	SOURCE
Background	Yes No	_____	_____
Alpha particles	Yes No	_____	_____
Beta particles	Yes No	_____	_____
Gamma radiation	Yes No	_____	_____

III. DESCRIPTION OF INCIDENT:

Quantity involved _____
Release information _____
_____
Monitoring/sampling recommended _____
_____

IV. RECOMMENDED PROTECTION:

Worker _____
_____
Public _____
_____

V. RECOMMENDED SITE CONTROL:

Hotline _____
_____
Decontamination line _____
_____

VI. REFERENCES FOR SOURCES:

_____
_____
_____
_____
_____
_____
_____

[1] Adapted from Standard Operating Safety Guides, EPA Publication 9285.1-03, 1992.

APPENDIX 12-E

Hazardous Material Control Zones

Control zones are the geographical areas within the control lines set up at a hazardous material incident. The three most commonly used are the:

- Exclusion Zone
- Contamination Reduction Zone, and
- Support Zone

The size and configuration of the zones are not static and should constantly be re-evaluated based on factors such as wind direction, release rate, etc.

Exclusion Zone - that area immediately around the spill. That area where contamination occurs or could occur. The innermost of the three zones at a site. Special protection is required for all personnel while in this zone. (Formerly referred to as the Hot Zone.)

Contamination Reduction Zone - that area between the Exclusion Zone and the Support Zone. This zone contains the personnel decontamination station. This zone may require a lesser degree of personnel protection than the Exclusion Zone. This area separates the contaminated area from the Support Zone and acts as a buffer to reduce contamination of the Support Zone. (Formerly referred to as the Warm Zone.)

Support Zone - the clean area outside of the Decontamination Control line where equipment or personnel are not expected to become contaminated and where special protective clothing is not required. This is where resources immediately supporting the hazardous material operation are located. The Command Post and media briefing site are located within the support zone. (Formerly referred to as the Cold Zone.)

SPECIAL NOTE: Use of Exposure Values

The effect of a hazardous substance is based on a reaction of exposed organisms or ecosystems to exposure. Various criteria are used to establish exposure limits to chemicals such as; threshold limit value (TLV®), short term exposure limit (STEL), immediately dangerous to life and health (IDLH), permissible exposure limits (PEL), emergency response planning guidelines (ERPG), etc. Recommended protection may vary widely based on the methodology used to determine these values. Care should be taken in using exposure values as the primary determinant of zone locations and protective action decisions. Victims can be allergic (hypersensitive), old, young, or infirm, and thus, be more at risk from exposure.

Activities Undertaken within Control Zones

Within the exclusion zone, responsibilities include: identifying the material(s) involved or threatened to be released; conducting rescue, if appropriate; and containing and abating the release or threatened release.

Within the contamination reduction zone, responsibilities include: decontamination of victims and emergency personnel, and establishing a safe refuge area.

Within the support zone, responsibilities include: providing for emergency medical care; providing an area for resources and staging; controlling access to all zones; and maintaining contact with the Incident Commander at the Incident Command Post.

Outside of the control zones, responsibilities include providing evacuation of endangered persons.

APPENDIX 12-F

Hazardous Material Responder Levels of Training

There are five levels of "employees who participate, or are expected to participate, in emergency response..." These minimum levels of training should be considered the basis for all responders. Higher degrees of initial and continuing training are recommended.

First Responder Awareness Level. First responders at the awareness levels are individuals who are likely to witness or discover a hazardous substance release and who have been trained to initiate an emergency response sequence by notifying the authorities of the release. First responders at the awareness level are required to have sufficient training or experience to objectively demonstrate competency in the following areas:

- An understanding of what hazardous materials are and the risks associated with them in an incident.
- An understanding of the potential outcomes associated with an emergency created when hazardous materials are present.
- The ability to recognize the presence of hazardous materials in an emergency.
- The ability to identify the hazardous materials, if possible.
- An understanding of the role of the first responder awareness individual in the employer's emergency response plan, including site security and control and the U.S. Department of Transportation's Emergency Response Guidebook.
- The ability to realize the need for additional resources, and to make appropriate notifications to the communication center.

First Responder Operations Level. First responders at the operations level are individuals who respond to releases or potential releases of hazardous substances as part of the initial response to the site for the purpose of protecting nearby persons, property, or the environment from the effects of the release. They are trained to respond in a defensive fashion without actually trying to stop the release. Their function is to contain the release from a safe distance, keep it from spreading, and prevent exposures. First responders at the operational level must receive at least eight hours of training or have had sufficient experience to objectively demonstrate competency in the following areas in addition to those listed for the awareness level and the employer shall so certify:

- Knowledge of the basic hazard and risk assessment techniques.
- Know how to select and use proper personal protective equipment provided to the first responder operational level.
- An understanding of basic hazardous materials terms.
- Know how to perform basic control, containment and/or confinement operations within the capabilities of the resources and personal protective equipment available within their unit.
- An understanding of the relevant standard operating procedures and termination procedures.

Hazardous Materials Technician. Hazardous materials technicians are individuals who respond to releases or potential releases for the purpose of stopping the release. They assume a more aggressive role than a first responder at the operations level in that they will approach the point of release in order to plug, patch or otherwise stop the release of a hazardous substance. Hazardous materials technicians receive at least 24 hours of training equal to the first responder operations level and, in addition, have competency in the following areas and the employer shall so certify:

- Know how to implement the employer's emergency response plan.
- Know the classification, identification and verification of known and unknown materials by using field survey instruments and equipment.
- Are able to function within an assigned role in the Incident Command System.
- Know how to select and use proper specialized chemical personal protective equipment provided to the hazardous materials technician.
- Understand hazard and risk assessment techniques.
- Are able to perform advance control, containment, and/or confinement operations within the capabilities of the resources and personal protective equipment available with the unit.
- Understand and implement decontamination procedures.
- Understand termination procedures.
- Understand basic chemical and toxicological terminology and behavior.

APPENDIX 12-F

Hazardous Material Responder Levels of Training, *continued*

Hazardous Materials Specialist. Hazardous materials specialists are individuals who respond with, and provide support to, hazardous materials technicians. Their duties parallel those of the hazardous materials technician. However, their duties require a more directed or specific knowledge of the various substances they may be called upon to contain. The hazardous materials specialist would also act as the site liaison with federal, state, local and other government authorities in regard to site activities. hazardous materials specialists receive at least 24 hours of training equal to the technician level and, in addition, have competency in the following areas and the employer shall so certify:

• Know how to implement the local emergency response plan.
• Understand classification, identification and verification of known and unknown materials by using advanced survey instruments and equipment.
• Know of the state emergency response plan.
• Are able to select and use proper specialized chemical personal protective equipment provided to the hazardous materials specialist.
• Understand in-depth hazard and risk techniques.
• Are able to perform specialized control, containment, and/or confinement operations within the capabilities of the resources and personal protective equipment available.
• Are able to determine and implement decontamination procedures.
• Have the ability to develop a site safety and control plan.
• Understand chemical, radiological, and toxicological terminology and behavior.

On Scene Incident Commander. Incident commanders, who will assume control of the incident scene beyond the first responder awareness level, receive at least 24 hours of training equal to the first responder operations level and, in addition, have competency in the following areas and the employer shall so certify:

• Know and be able to implement the employer's Incident Command system.
• Know how to implement the employer's emergency response plan.
• Know and understand the hazards and risks associated with employees working in chemical protective clothing.
• Know how to implement the local emergency response plan.
• Know of the state emergency response plan and of the Federal Regional Response Team.
• Know and understand the importance of decontamination procedures.

These categories of responders are similar to those that may likely be encountered in the field. All public agency employees that have the potential of being involved in a hazardous material incident should have, at the minimum, first responder awareness level training. **Do not assume what level of training responders might have.**

APPENDIX 12-F

Recommended Training by Job Category

TRAINING TOPIC	EMPHASIS OF TRAINING	General Site Worker	On site Management & Supervisors	Health & Safety Staff
Biology, Chemistry, and Physics of Hazardous Materials	Chemical and physical properties; chemical reactions; chemical compatibilities	X	X	X
Toxicology	Dosage, exposure routes, toxicity, IDLH values, PELs, recommended exposure limits (RELs), TLVs®	**X**	**X**	**X**
Industrial Hygiene	Monitoring workers' need for and selection of PPE	O	X	X
	Calculation of doses and exposure levels; hazard evaluation; selection of worker health and safety protective measures.	O	X	X
Monitoring Equipment	Selection, use, capabilities, limitations, and maintenance.	X	X	X
Hazard Evaluation/Recognition	Techniques of sampling and assessment.	X	X	X
	Evaluation of field and lab results.	O	X	X
	Chemical/Physical	X	X	X
	Risk assessment.		O	X
Site Safety Plan	Safe practices, safety briefings and meetings, standard operating procedures, site safety map.	X	X	X
Standard Operating Procedures	Hands-on practice.	X	X	X
	Development and compliance.	O	X	X

X = Recommended Training
O = Optional Training

APPENDIX 12-F

Recommended Training by Job Category, *continued*

TRAINING TOPIC	EMPHASIS OF TRAINING	General Site Worker	On site Management & Supervisors	Health & Safety Staff
Engineering Controls	The use of barriers, isolation, and distance to minimize hazards.	X	X	X
Personal Protective Clothing and Equipment	Assignment, sizing, fit-testing, maintenance, use. limitations, and hands-on training.	X	X	X
	Selection of PPE.	X	X	X
Medical Program	Medical monitoring, first aid, stress recognition.	X	X	X
	CPR and emergencies drills.	O	X	X
	Design and planning.		O	X
	Implementation.	X	X	X
Decontamination	Hands-on training using simulated field conditions.	X	X	X
	Design and maintenance.	X	X	X
Legal and Regulatory Aspects	Applicable safety and health regulations (OSHA, EPA)	O	X	X
Emergencies/Accidents	Emergency help, self-rescue, drills, alarms, reporting.	X	X	X
	Emergency response, investigation, and documentation.	O	X	X
Hazard Communication	Per 29 CFR 1910.1200 and 1926.59 (as applicable)	X	X	X
Employee Rights	Employee rights	X	X	X

X = Recommended Training
O = Optional Training